

Introduction to Embedded Systems & Microcontrollers

What is Embedded Systems

It is all about inserting a small computer within a system to be operated.

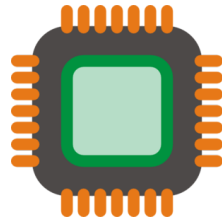
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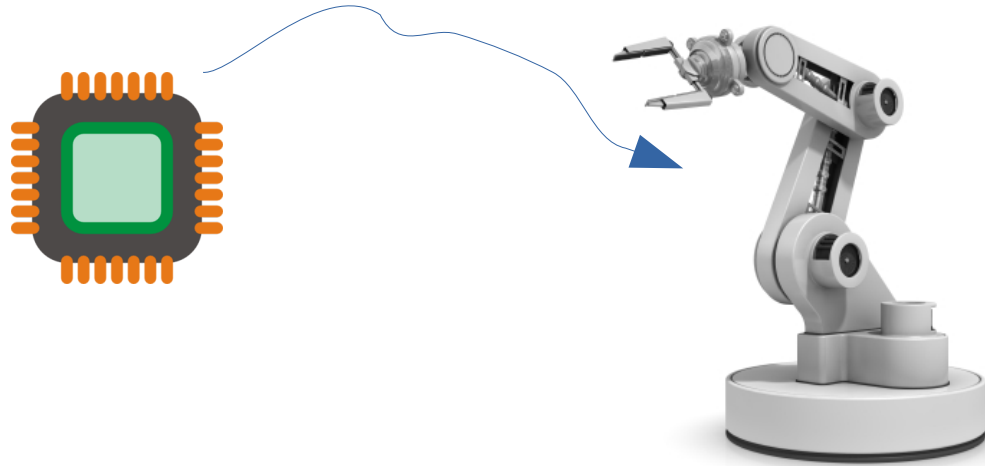
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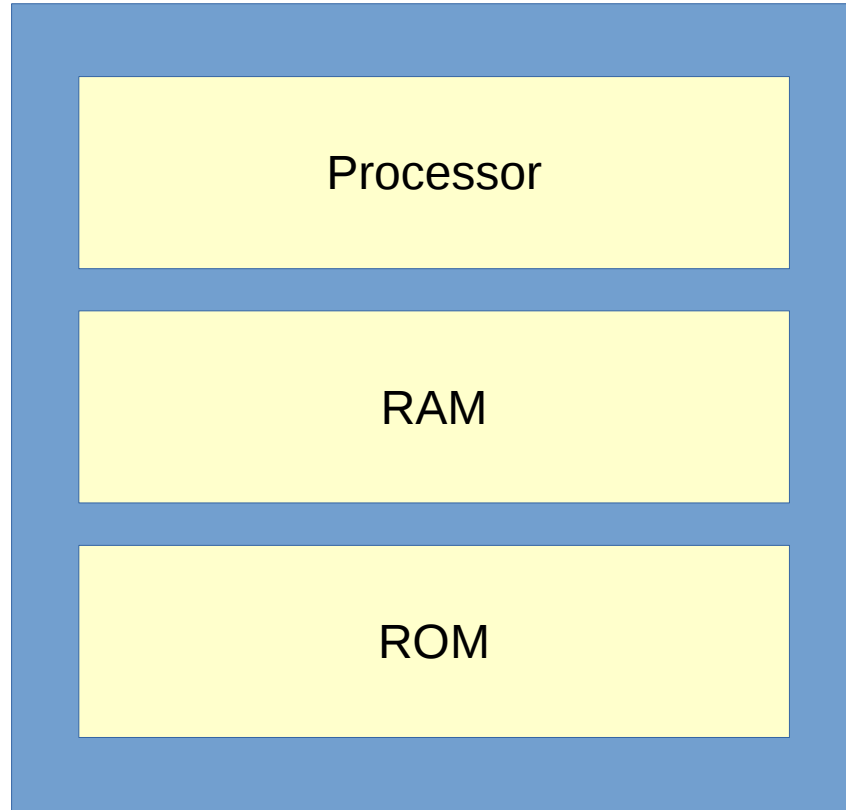


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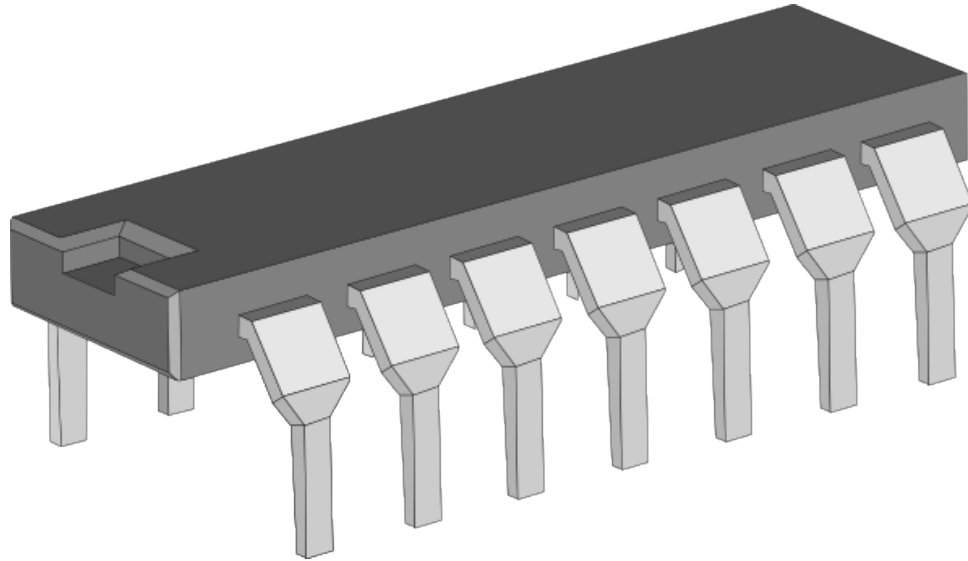
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What is a computer?

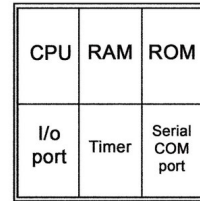
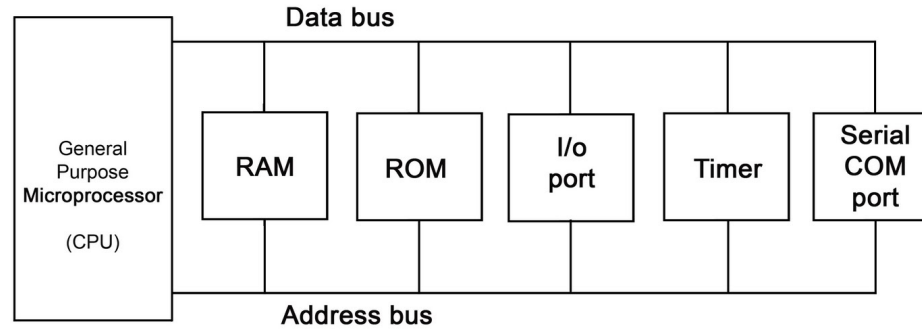


What is a Microcontroller?



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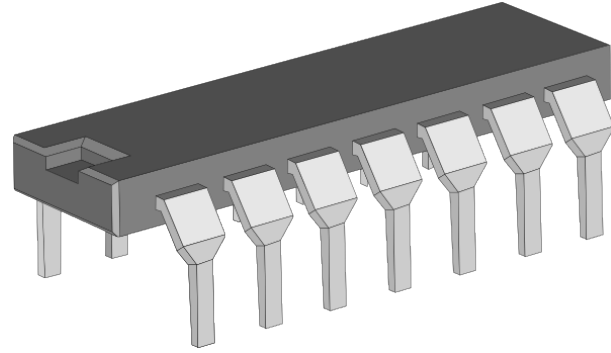
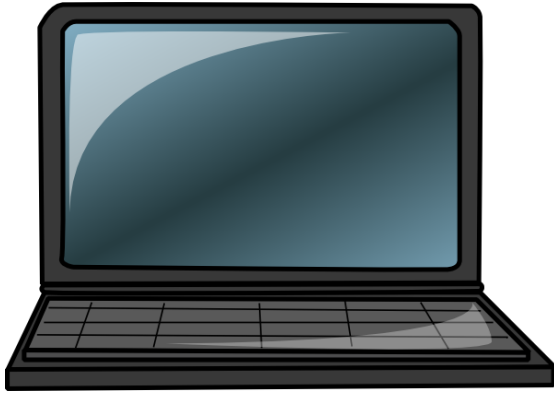
Microprocessor vs. Microcontroller:



(Single chip)

What is a Microcontroller?

PC vs. Microcontroller:

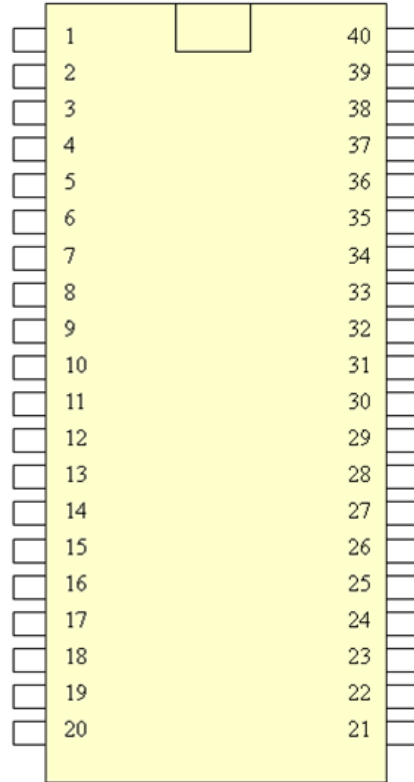


What is a Microcontroller?

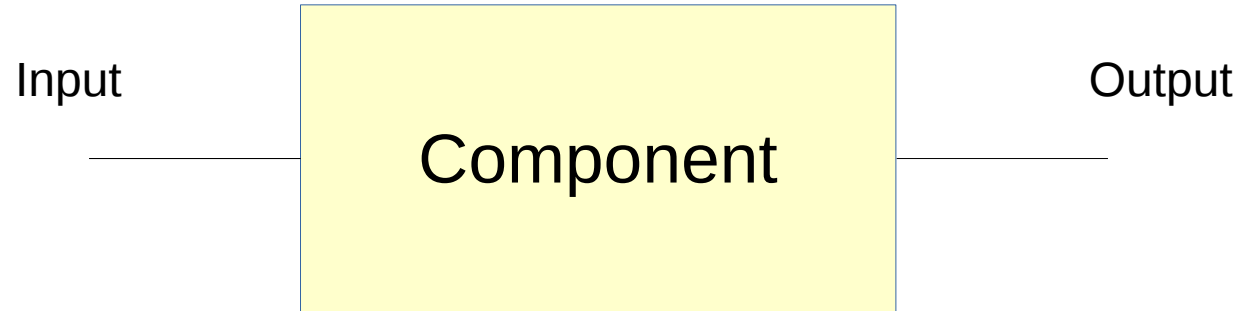
How to choose a microcontroller?

- Speed.
- Cost.
- RAM & ROM size.
- Number of I/O pins.
- Power Consumption.
- Available special modules: (Timers, ADC, Communication protocols, ... etc).
- Packaging.

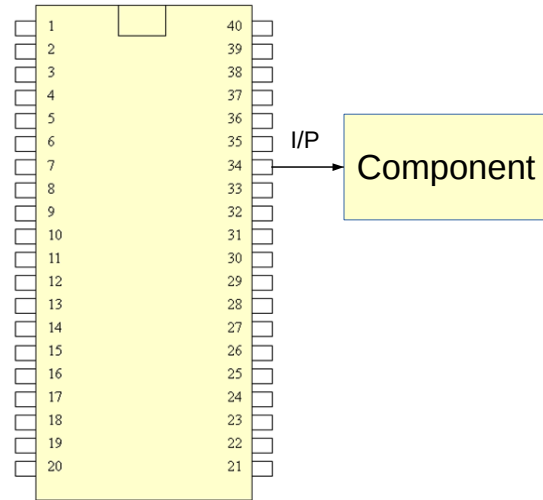
What is a Microcontroller?



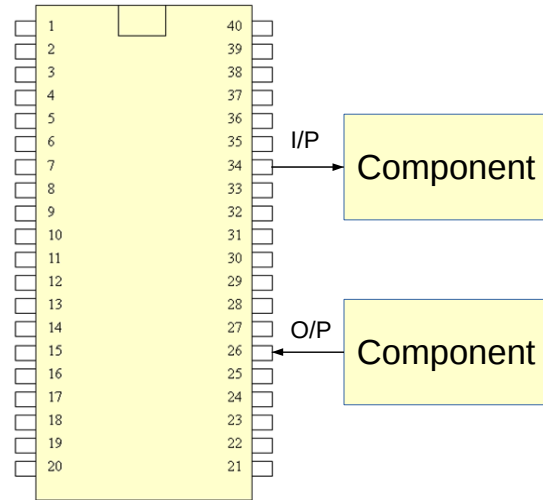
Some components



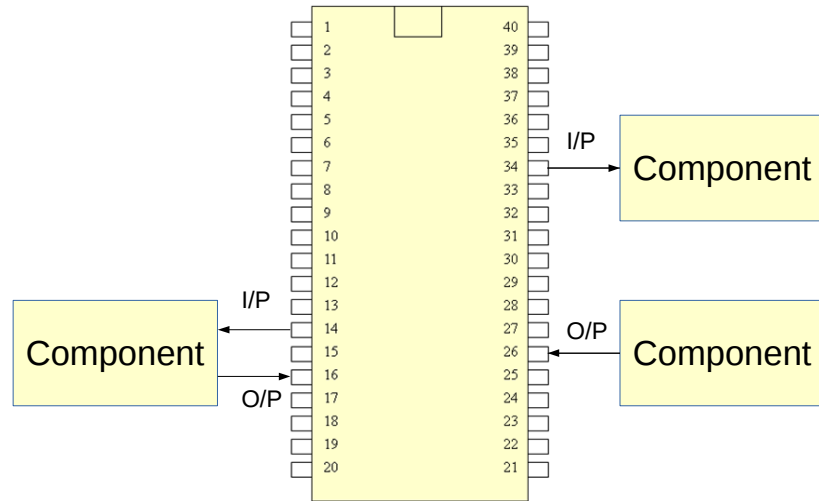
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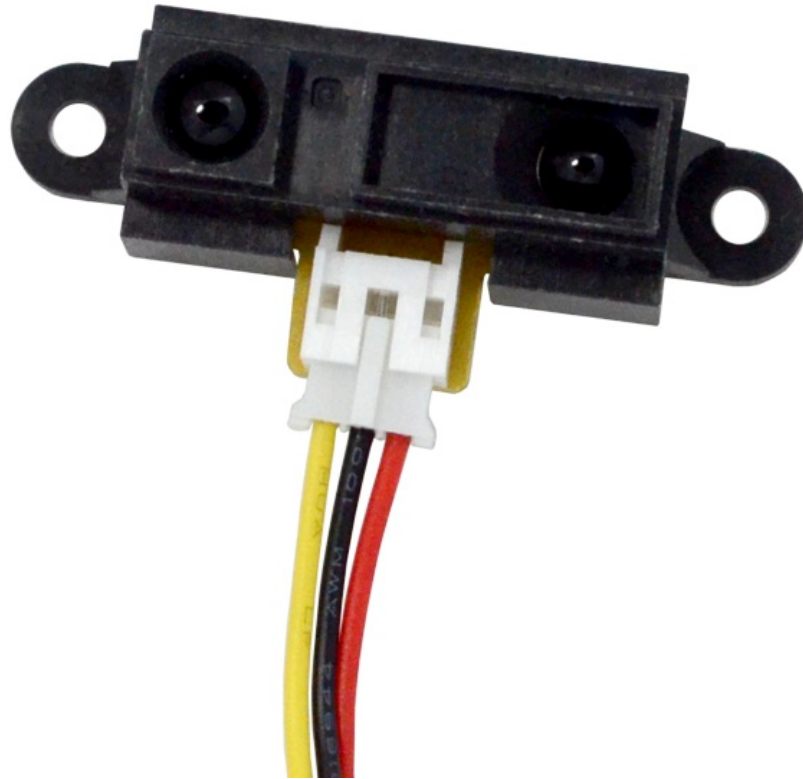
Some components

Ultrasonic Sensor:



Some components

IR Proximity Sensor:



How to use a Multimeter?



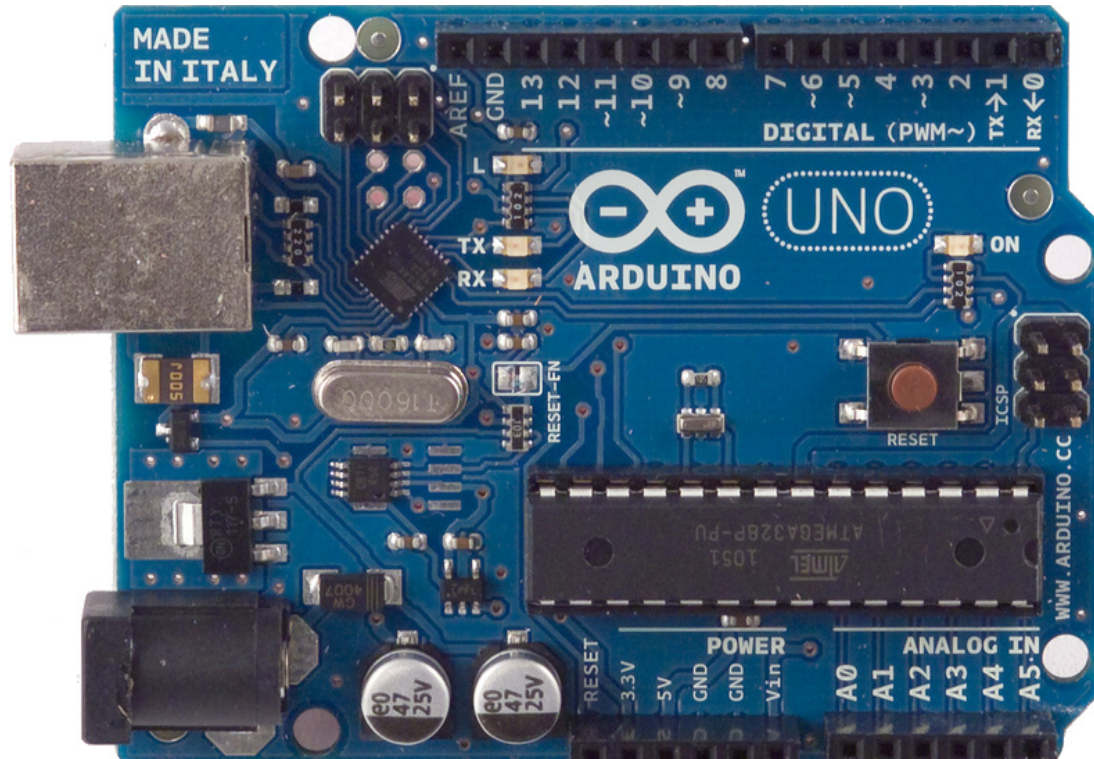
Microcontroller Example

Atmel ATmega328/p:

• Pin Count	28
• Flash (Bytes)	32K
• SRAM (Bytes)	2K
• EEPROM (Bytes)	1K
• General Purpose I/O Lines	23
• SPI	2
• TWI (I2C)	1
• USART	1
• ADC	10-bit 15kSPS
• ADC Channels	8
• 8-bit Timer/Counters	2
• 16-bit Timer/Counters	1

What is Arduino?

Arduino Uno:

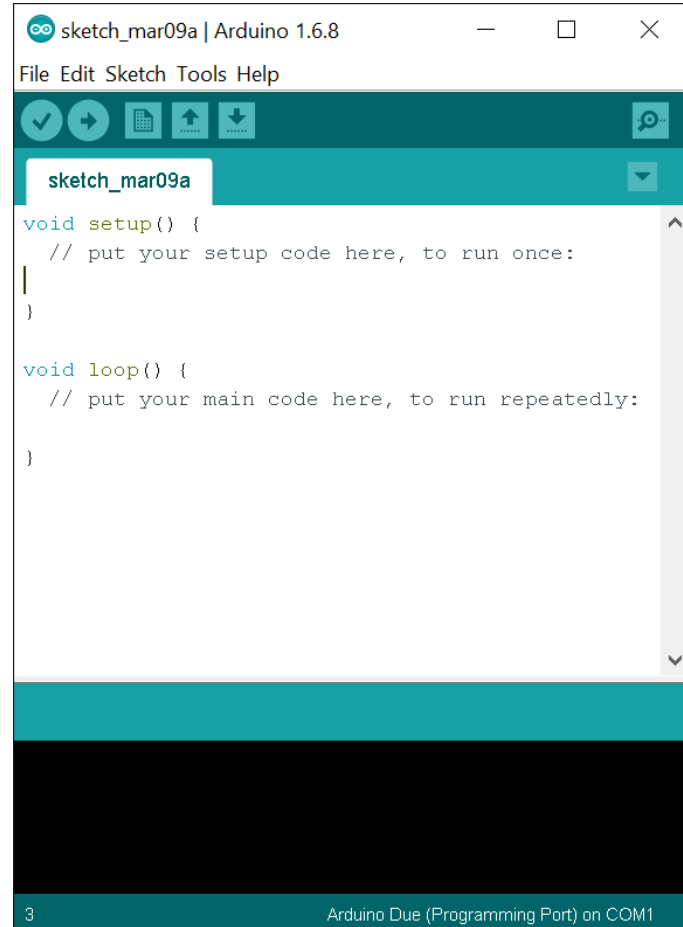


What is Arduino?

• Microcontroller	ATmega328P
• Operating Voltage	5V
• Input Voltage (recommended)	7-12V
• Input Voltage (limit)	6-20V
• Digital I/O Pins	14 (of which 6 provide PWM output)
• PWM Digital I/O Pins	6
• Analog Input Pins	6
• DC Current per I/O Pin	20 mA
• DC Current for 3.3V Pin	50 mA
• Flash Memory	32 KB (ATmega328P)
• SRAM	2 KB (ATmega328P)
• EEPROM	1 KB (ATmega328P)
• Clock Speed	16 MHz
• LED_BUILTIN	13
• Length	68.6 mm
• Width	53.4 mm
• Weight	25 g

What is Arduino?

Arduino IDE:



References

- www.arduino.cc.
- ATmega328/P Datasheet.

Thanks